85 Is There Room for One More?

In this unit, you've learned to interpret population graphs and to analyze effects of factors such as competition, predators, and various environmental conditions on population size. Can a population graph tell you how much room there is for a particular species in a habitat? What does it mean for a population to run out of space?

CHALLENGE **What is carrying capacity?**

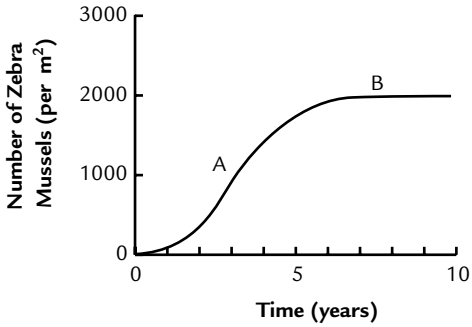
MATERIALS

For each student

Student Sheet 77.2, "Anticipation Guide: Introduced Specie—Zebra Mussels," from Activity 77

READING

Imagine that you are a field ecologist. You've been studying a small lake called Lake Ness for the past ten years. You first began work at the lake when you heard that zebra mussels had invaded a nearby river, one that connects to Lake Ness. After ten years of study, you feel satisfied that you have a good idea of how quickly the zebra mussel can populate a lake of this size. You've been keeping an ongoing count of the zebra mussels in the lake (in mussels per square meter). At this point, your graph of population size looks like Graph 1.



GRAPH 1: ZEBRA MUSSEL POPULATION OF LAKE NESS OVER 10 YEARS

STOPPING TO THINK 1

Recall that zebra mussels get their food by filtering plankton out of the water. Look at Graph 1. What do you think is happening to the quantity of plankton at:

a. Point A? Explain your reasoning.

b. Point B? Explain your reasoning.

As a result of your analysis, you think you have identified the maximum number of zebra mussels that could live successfully in Lake Ness. You think this might be the **carrying capacity** of the lake for zebra mussels. This term suggests the amount a container can hold, or carry. But unlike the capacity of a container, the number of zebra mussels that the lake can successfully hold may change over time, based on both living and non-living factors.

A few days later, your friend Nadia comes to visit you from the city. She drove up to the lake in her new car. "It has a carrying capacity of five passengers," she brags. Since you've never seen her drive anyone but her best friend and her dog, you simply shrug.

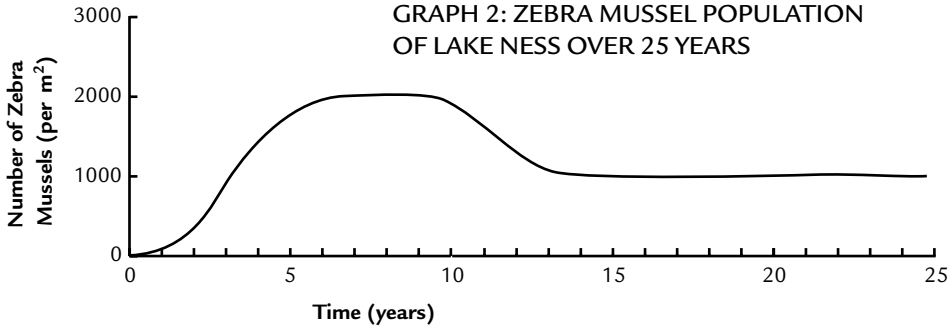
STOPPING TO THINK 2

a. Look again at Graph 1. What is the carrying capacity of zebra mussels in Lake Ness? How did you determine this?

b. List some of the factors that might affect this carrying capacity.

After Nadia leaves, you spend a week organizing your data. You decide to stop studying Lake Ness so closely for a while. Instead, you'll return to the lake once a year. During each visit, you'll check on the zebra mussel population. Fifteen years pass. A graph of your data now looks like Graph 2.

GRAPH 2: ZEBRA MUSSEL POPULATION OF LAKE NESS OVER 25 YEARS



STOPPING TO THINK 3

a. What is the carrying capacity for zebra mussels in Lake Ness between Years 13 and 25?

b. Identify at least three non-living factors that may have caused the carrying capacity to change. Explain how each factor could cause this change in carrying capacity.

c. Identify at least three living factors that may have caused the carrying capacity to change. Explain how each factor could cause this change in carrying capacity.

d. Do you think that the zebra mussel population will return to the level it had reached between Years 5 and 10? Why or why not?

For twelve years now, you've been puzzled by the change in the zebra mussel population. For example, in all your years of study, you've found no evidence of a new predator of zebra mussels appearing in the lake. You remain convinced that something about the zebra mussel's habitat must have changed to cause this shift in the population level. Consulting public records, you discover that a new factory was built just three miles from the lake about fifteen years ago!

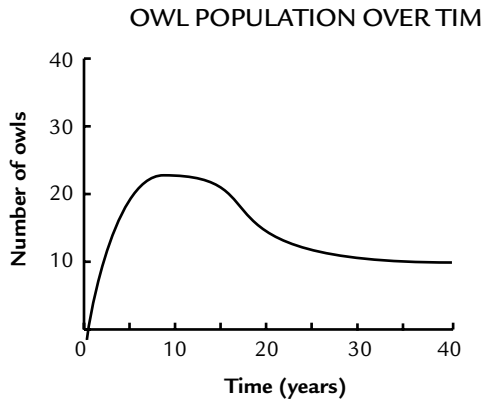
Energized, you decide to test your hypothesis. You set up two identical tanks. One tank contains water from Lake Ness. The other tank contains water from a similar lake that is higher up in the mountains and farther from the factory. You add exactly ten adult zebra mussels to each tank. Every day, you supply the two tanks with fresh plankton, which you culture in a separate tank. Several months later, you are puzzled to find no difference at all in the zebra mussel populations of the two tanks.

STOPPING TO THINK 4

Is this a good experiment to test the hypothesis that the factory was affecting the zebra mussel population? Explain.

ANALYSIS

1. Shown below is the population graph from the Analysis section of Activity 78, "Coughing Up Clues."



   a. What is the carrying capacity for owls in this habitat?

   b. How did the carrying capacity change during this 40-year period? Explain.

   c. What living and non-living factors might explain this change in carrying capacity?

2. Fill in the "After" column for Statements 9 and 10 only on Sheet 77.2, "Anticipation Guide: Introduced Species—Zebra Mussels." Did your thinking change?

3. Turn back to Activity 72, "The Miracle Fish?" and look at the graph showing the amount of fish caught in Lake Victoria. Can you determine the carrying capacity of Nile perch in Lake Victoria based on this graph? Explain.

4. **Reflection:** Consider the introduced species you have been researching. Identify one ecosystem into which it has been introduced. Do you think this species has reached its carrying capacity in this ecosystem? Explain.